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The Mineral Industry of Nigeria

UNITED STATES DEPARTMENT OF THE INTERIOR

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The Mineral Industry of Nigeria

By Michael D. Fenton[1]

The petroleum sector continued to dominate the Nigerian economy with crude oil exports accounting for about 95% of the country's export revenues and 70% of the Government's budgetary resources. Nigeria's proven reserves of oil were over 16 billion barrels, and short-term productive capacity was about 1.8 million barrels per day (bbl/d). Nigeria was ninth in the world with about 84 trillion cubic feet of natural gas reserves, 70% of which were onshore, and all were in the Niger Delta area. Some associated gas was used industrially, but large nonassociated gasfields were unexploited. The Nigerian National Petroleum Corp. (NNPC) marketed 70% of total oil production in the country, and its activities accounted for 20% of Nigeria's gross domestic product.

The Government announced that it planned to phase out petroleum subsidies beginning March 1988, which cost the Government about $1.6 billion per year. Crude oil was sold in Nigeria for about $2.70 per barrel while the international price was about $18. Petroleum product prices in Nigeria were six to eight times below the prices prevailing in neighboring African countries, and cancellation of subsidies would tend to decrease the estimated 30,000 to 50,000 bbl/d of gasoline smuggled out of Nigeria.

The mining sector of the economy appeared to be in a state of deep crisis during 1987.[2] Mining revenue declined owing to inadequate supplies of spare parts for maintenance, deterioration of physical plants, reduced demand from domestic consumers, and the usual problems associated with underdevelopment: inexperienced management, unskilled labor, inadequate financing, and bureaucracy. Nevertheless, the Nigerian Mining Corp. (NMC) announced that it planned to increase exploration for lead, rock salt, uranium, and zinc.

PRODUCTION AND TRADE

As a member of the Organization of Petroleum Exporting Countries (OPEC) and its sixth-largest producer, Nigeria began the year with a new OPEC oil production quota of 1.238 million bbl/d, and it announced that it would phase out all netback agreements by February 1 in favor of an official fixed price of $18.92 for Bonny Light crude oil. This action was consistent with OPEC's new policy of maintaining oil at or above $18 per barrel, and it closely followed a similar netback cancellation by Saudi Arabia. Under a netback arrangement, the price of crude oil was based on the prevailing value of oil products, including gasoline and heating oil, on the open market. Problems developed immediately for the oil-producing companies within Nigeria and the Nigerian Government when Nigerian Bonny Light began trading on the European spot market at a premium of as much as $0.18 above competing North Sea Brent crude, which had fallen below $18 per barrel, well below Nigeria's $18.92 official selling price. Also, as an indication of resistance by markets to fixed prices, Nigeria's oil production fell from 1.28 million bbl/d to 1.05 million bbl/d in January. The new pricing policy was of considerable concern to oil-producing companies within Nigeria

because they were obligated to lift the NNPC's share of production. Falling world prices for oil were expected to erode a previously agreed-upon $2 per barrel profit margin if they found themselves committed to lift unattractively priced NNPC oil in addition to their equity crude. Negotiations over the complex issues of prices, profit margins, and taxes were continuing through July at which time the OPEC quota was raised to 1.301 million bbl/d and production rose to that level.

Production of oil declined by about 9% below that of 1986 to an annual average of 1.33 million bbl/d, which conformed to Nigeria's OPEC quota of 1.301 million bbl/d plus additional production deemed to be condensate. Production of associated gas was 660 billion cubic feet, of which 473 billion cubic feet was flared. The only significant exploitation of gas was as feedstock in the nitrogenous fertilizer plant operated by National Fertilizer Co. of Nigeria at Onne, near Port Harcourt in Rivers State. Nigeria earned about $6.5 billion from oil exports in 1987, about the same as in 1986. In contrast, 1980 earnings were about $25 billion.

Three operating petroleum refineries had a combined design capacity of 260,000 bbl/d, but technical constraints restricted throughput, and refined products were imported to meet domestic demand of about 265,000 bbl/d. NNPC exported oil for offshore processing and brought back products, particularly gasoline and kerosene, to make up shortfalls. Residual fuel oil in excess of domestic demand was exported to the U.S. east coast.

NNPC's refineries had a combined design capacity of nearly 2.2 million barrels per year of liquefied petroleum gas (LPG), but actual production never exceeded 1.16 million barrels. Production during 1987 was estimated by NNPC at only 837,000 barrels, and Nigeria imported nearly 700,000 barrels of LPG during the year. The Government was trying to encourage domestic consumption of LPG in rural areas to replace kerosene and firewood, but the high cost of LPG cooking equipment was a problem to be resolved.

The Government announced that Nigeria had been allocated a production quota of about 1,500 tons of tin by the Association of Tin Producing Countries (ATPC). Production of tin concentrates and metal increased in 1987. Over 500 tons was exported to Europe, and the remainder was sold locally in the form of tin with its alloys of lead and antimony. Makeri smelted less than its annual allocation from ATPC, a result of low world tin prices. Exploration for lode and alluvial tin included geological mapping, trenching, and sampling in the Darkuma and Iregun areas.

Coal mining, one of the oldest industries in Nigeria, was producing far below its potential. Problems in the industry included poor finance, unsteady power supply, lack of equipment, and obsolete infrastructure. In early 1987, the Government reversed itself by pledging the development of the coal industry to satisfy foreign demand and to earn needed export revenue. Italy took 30,000 tons of coal in 1986, and the Government claimed that inquiries had been made from other markets about the availability of as much as 5 million tons of Nigerian coal per year. Barter trade deals had been suggested that would trade coal for modern mining equipment. The Government also expected that domestic demand would increase as several planned coal-fired powerplants are built. The Nigerian Coal Corp.'s (NCC) new development program covered expansion of the Enugu underground mines in Anambra State, as well as the Okaba and Owukpa open pit mines and development of a new mine at Ogbouoga in Benue State. The goal was to increase annual production to 3 million tons by 1990, of which about two-thirds would be for export, and about 300,000 tons would be for the Ajaokuta steel plants for blending with imported coking coal. The source of funds for this ambitious program was not stated.

The NCC produced 110,170 tons of coal from four mines during 1987. The Okpara and Onyeama underground mines produced 31,256 tons and 33,358 tons, respectively. The open pit Owukpa and Okala mines produced 18,567 tons and 26,989 tons, respectively. NCC was doing geological and geophysical investigations of coal deposits west of the Enugu coalfield to update the coal reserve and to determine future mining methods. All production was needed domestically; therefore, none was exported.

The Delta Steel Co. (Aladja) steel production plant at Aladja and the three rolling mills at Jos, Oshogbo, and Katsina were operating at less than one-third of capacity over the past 2 years. They depended on imports of iron ore from Brazil and Liberia and steel billets from Western Europe. Aladja's production since its beginning 4 years ago was 630,000 tons of steel billets. Its 1987 production was slightly more than that of 1986, but was less than one-half of planned

production. The quantities of materials produced were as follows: rolled products, 53,762 tons; billets, 130,381 tons; liquid steel, 136,552 tons; direct-reduction iron, 130,772 tons; oxide pellets, 165,915 tons; burnt lime, 13,398 tons; and foundry products, 650 tons.

The Katsina steel rolling mill's output of 32,000 tons of products was significantly less than the 62,535 tons produced in 1986. Billets were in short supply because of the low value of the Nigerian currency in the foreign exchange market, the lack of spare parts, and the rising cost of energy. New products planned for 1988 were galvanized wire and welding electrodes.

The National Iron Ore Mining Co. produced 240,000 tons of ore during 1987, compared with a projected figure of 410,000 tons. Apparently, adequate funds were unavailable for needed mining haulage and loading equipment.

Table 1.—Nigeria: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1983	1984	1985	1986[p]	1987[e]
METALS					
Columbium and tantalum concentrates, gross weight:					
Columbite	87	120	100	13	48
Tantalite	1	1	1	--	--
Iron and steel: Metal: Steel, crude	140,000	180,000	254,000	200,000	136,000
Lead:					
Mine output, Pb content[e]	260	200	260	100	NA
Metal, refined, secondary	2,000	2,000	3,000	3,500	NA
Tin:					
Mine output, cassiterite concentrate:					
Gross weight (73.5% Sn)	1,560	1,700	1,550	630	[2]844
Sn content	[r]1,600	1,340	1,100	460	603
Metal, smelter	[r]1,400	1,344	1,079	91	560
Zinc ore and concentrate, Zn content	[3]	[3]	1,000	[3]	[3]
INDUSTRIAL MINERALS					
Cement, hydraulic thousand tons	3,600	3,600	3,600	3,863	[e]3,800
Clays:					
Kaolin	700	286	300	[3]	177
Unspecified	20,000	20,000	20,000	15,000	NA
Feldspar[e]	5,000	--	5,000	3,500	485
Stone:					
Limestone thousand tons	1,400	1,890	1,800	1,850	2,627
Marble	3,000	1,200	1,200	1,482	3,500
Shale thousand tons	140	127	120	104	88
MINERAL FUELS AND RELATED MATERIALS					
Coal do.	53	76	55	150	110
Gas, natural:					
Gross million cubic feet	655,000	174,000	96,000	72,200	65,992
Marketed do.	18,000	18,000	18,000	20,000	47,225
Petroleum:					
Crude thousand 42-gallon barrels	452,000	508,000	544,252	534,165	486,869
Refinery products:					
Gasoline do.	11,100	22,000	22,900	18,660	12,050
Jet fuel do.	400	400	400	375	490
Kerosene do.	6,200	6,400	10,000	8,700	6,750
Distillate fuel oil do.	14,547	14,547	17,500	12,400	2,500
Residual fuel oil do.	9,990	9,990	11,300	15,300	NA
Unspecified do.	1,048	1,563	3,700	4,700	660
Total do.	43,285	54,900	65,800	60,135	22,450

[e]Estimated. [p]Preliminary. [r]Revised. NA Not available.
[1]Includes data available through Oct. 5, 1988.
[2]Reported figure.
[3]Less than 1/2 unit.

COMMODITY REVIEW

METALS

Gold.—NMC announced that gold had been found in commercial quantities in Kaduna, Kwara, Niger, Oyo, and Sokoto States. Gold concentrates were being produced and stockpiled in Ilesha, Oyo State. However, sales were not scheduled until refining equipment could be obtained. The gold reserve was estimated at about 120,000 troy ounces.

Exploration at the Iperindo Reef included drilling 1,488 meters in 16 holes within 40 meters of the ground surface, digging over 1,300 pits for sampling, and channel sampling of 2 old adits.

Two hundred and eighty-nine holes were drilled to a cumulative depth of 672 meters in ore blocks B, C, D, F, and O at the Itagunmodi alluvial deposit, and 603 heavy-mineral concentrate samples were collected and amalgamated. The total gold reserve of 11 ore blocks over an area of 94.6 hectares was 186 kilograms (6,000 troy ounces), based on a cutoff grade of 0.02 gram (0.0006 troy ounce) per cubic meter.

At the Okolom alluvial deposit, an area of about 70 square kilometers around the main vein was mapped geologically at a scale of 1:25,000. Also, 1,648 pits were dug to an average pit depth of 1.8 meters over a 30-hectare area for the collection of 2,193 heavy-mineral samples.

Iron and Steel.—The Associated Ores Mining Co. stockpiled for beneficiation over 350,000 tons of low-grade iron ore from the Itakpe Hill Mine. Construction of the platform and excavation of the foundations for the new crushing plant began in December, and a contract was awarded for the construction of a 65-kilometer railway and the supply of locomotives and rolling stock. The contract for the beneficiation plant and the dam at Osara had not yet been signed. Workshops, a warehouse, roads, and a town were also planned.

Construction continued with technical assistance from the Soviet Union on the Ajaokuta Steel Co. Ltd. plant in Kwara State with an expected full commissioning by 1989. Phase 1, consisting mainly of four rolling mills, an oxygen blast furnace, and ancillary facilities, was originally due for completion in 1983. Two rolling mills, the light steel mill and wire rod mill, were commissioned in 1983 and 1984, respectively, and then processed imported billets. During 1987, the light section and bar mill, wire rod mill, mechanical repair shop, forge and fabrication shop, thermal powerplant, compressor house, water treatment plants, and other shops were completed and operational. Work continued on the continuous-production billet mill, 110-megawatt powerplant, and the foundry and pattern-making shops. The capacity of the plant was to be 1.3 million tons annually with the commissioning at the end of 1989 of the main oxygen blast furnace. Dolomite, iron ore, limestone, and refractory clay would come from local sources; calcined bauxite, coking coal, and manganese would initially be imported. A proposed additional plant would produce flat-steel products, which constitutes about one-half of the total steel consumption in Nigeria.

The Niger Steel Co. was to be reactivated under a technical and management agreement with a group of three U.S. companies and Industrial Dynamics Co. of Nigeria. The U.S. consortium was to supply the plants and equipment as well as manage the company.

Lead and Zinc.—The Enyigba lead-zinc-salt mine at Abakaliki, which was inoperative since mid-1984, was to be reopened, and a contract was awarded for a feasibility study.

Tin.—The Makeri Smelting Corp., Nigeria's sole tin metal producer with a capacity of 13,500 tons per year, became totally Government owned after Amalgamated Metal Co. sold its 40% share.

INDUSTRIAL MINERALS

Barite.—Production during 1987 by NMC was 21,019 tons, 12,488 tons, and 4,794 tons from the quarry, crusher, and jig, respectively. Output from the quarry and crusher exceeded goals. A second jig for treating coarse material at the site was completed, and an access road was constructed from Adudu to Azara. Production went to Dresser Nigeria Ltd. and Baroid Drilling Chemical Products Ltd. to be used for oil well drilling.

Clays.—*Bentonite.*—At the Damboa bentonite deposit, samples were collected for analysis from 15 pits along 4,200 meters of grid lines. Clay samples were also collected for testing from deep-water boreholes. The clays in the area may be suitable for the

production of drilling mud.

Brick.—The five operating brick plants produced 20.4 million brick units, which was an improvement over 1986 production. Demand was greater than supply as the preferred building material shifted from cement back to brick.

Kaolin.—Production of crude kaolin at the Major Porter Mine was only 300 tons during 1987 because operations were suspended for most of the year to await the commissioning of the washing plant.

Refractory.—NMC analyzed 78 split-core samples and also bulk samples from the Giro clay deposit. Analytical results show that the clay had high aluminum oxide and low ferrous oxide content.

Cement.—The United Nations Industrial Development Organization (UNIDO) agreed to provide technical assistance and managerial support to improve performance of the 600,000-ton-per-year cement plant owned by Cement Co. of Northern Nigeria (CCNN) at Sokoto. The cost of $4.8 million was to be paid by CCNN. Nigerian personnel would be trained to replace UNIDO personnel by 1989.

West African Portland Cement Co. (Wapco) increased turnover and profits during the first half of 1987 after a 9% increase in sales volume in 1986 and an increase in selling prices. Profits increased from $2.5 million to $5.4 million.

Diatomite.—At the Bularaba diatomite mine, 1,600 tons of crude diatomite ore was mined and stockpiled while calcination test work was being done in Kenya.

About 1 square kilometer of ground surrounding the main diatomite outcrop in Abakire was investigated. Work included geological mapping, surveying, drilling, sampling, and laboratory analysis.

Feldspar and Quartz.—Production at the Lokoja quarry was 2,494 tons of feldspar and 1,282 tons of quartz; at the crusher, production was 1,527 tons and 860 tons of feldspar and quartz, respectively. Production was less than expected because of a shortage of machinery and inadequate geological information.

Trenching of vein 5 at Lokja showed the need for a drilling program. Seventeen boreholes were drilled on veins 1 and 4 with a cumulative depth of 194 meters. The results compared favorably with those of the vein being exploited.

Fertilizer Materials.—At midyear, the National Fertilizer Co. of Nigeria Ltd. exported 8,000 tons of ammonia to Spain, representing the first production from the new 272,000-ton-per-year ammonia plant at Onne, near Port Harcourt. The urea unit came on-stream in September, but startup of the 300,000-ton-per-year compound fertilizer plant at the site was delayed until 1988 because foreign exchange was unavailable to procure the phosphate and potash inputs.

Granite.—NMC continued to supply aggregate for construction purposes, but decreasing local demand forced the temporary closure of some quarries. The lack of spare parts and replacement equipment precluded increases in production where demand was high.

Salt.—NNPC evaluated its Oku Lake seismic data and held meetings with NMC for a possible joint-venture to explore for salt in the Oku Lake structure. A 2,100-meter borehole was being considered by these groups.

MINERAL FUELS

Coal.—Several private companies were licensed by the Government to mine coal, including the local companies Mosheshie General Merchants (MGM), Suliaswua Enterprises, and Yulako Investment Co., with concessions at Owukpa in Benue State. Italco-Avice Services, jointly owned by Italy and Nigeria, began mining coal at Owukpa in early 1986. The Government was also considering applications for concessions at Enugu and Benue from 10 other Nigerian and joint-venture companies.

Petroleum.—*Exploration.*—Exploration momentum continued upward since the 4-year downward trend ended in early 1986. Nineteen exploratory wells were drilled in 1987; 22 were drilled in 1986. The number of appraisal and development wells drilled increased from 53 in 1986 to 65 in 1987. The Shell Petroleum Development Co. of Nigeria made two major oil discoveries in Bendel State. Exploration at Gbetiokun I established preliminary reserves of more than 50 million barrels after drilling penetrated 420-foot-thick oil sands and 31-foot-thick gas sands in different reservoirs. An Opomoyo I exploration well penetrated 221-foot-thick oil sands and 43-foot-thick gas sands; the initial reserve estimate was more than 30 million barrels.

Mobil Producing Nigeria, operator of the Mobil-Nigerian National Petroleum Corp. (NPN) joint venture, discovered the Inuen offshore oilfield 30 miles south of NPN's Qua Iboe terminal in southeast Nigeria. The Inuen-1 well, in 176 feet of water, produced 4,600 bbl/d of 38-API oil. In the

same area, the Iyak-3 appraisal well tested oil at a northwestern extension to southeastern Iyak field. 26 miles of Qua Iboe, and 2,700 bbl/d of 36-API oil flowed through a 1/2-inch choke.

NNPC made a noncommercial oil and gas discovery in the northern State of Borno at Gaji Ganna, near Maiduguri, after 10 years of exploration. A total of 10 wells were to be drilled by yearend in the remote region.

Refineries.—Progress was made toward the completion of Nigeria's fourth refinery being built at Alesa-Eleme near Port Harcourt. The $500 million project, undertaken by a Japanese-French consortium, was to have a capacity of 150,000 bbl/d. The new refinery would elevate Nigeria's total nameplate refining capacity to 435,000 bbl/d.

Transportation.—NNPC planned to lay a second oil pipeline across the Escravos River because of a crack in the existing 376-mile-long, 36-inch System 2C line that moves oil to the Kaduna refinery from Escravos.

Petrochemicals.—Two new petrochemical plants were to be commissioned at yearend as the first phase of Nigeria's new petrochemical industry. The Warri complex was to begin producing 37,000 tons per year of polypropylene and 18,000 tons per year of carbon black. The Kaduna plant would produce 30,000 tons per year of linear alkyl benzene.

SRI International completed its feasibility study on the petrochemicals industry for NNPC and recommended a project costing an initial $453 million, which would increase to $615 million after expansion. Proposed annual production was ethylene, 170,000 tons, with possible expansion to 260,000 tons; polyethylene, 164,000 tons, with possible expansion to 250,000 tons; and polypropylene, 80,000 tons. A $213 million natural gas liquids plant was also recommended.

Natural Gas.—NNPC awarded a $310 million turnkey contract to Saipem S.p.A. and to Snamprogetti S.p.A. of Italy to lay gas pipelines to develop the Warri Gasfield. The group was to supply design, materials, and equipment, and construct the 236-mile, 36-inch network by mid-1988 from Warri to an electric powerplant at Egbin, near Lagos. However, Nigeria failed to get a World Bank loan for construction because it did not conform to competitive bidding requirements.

NNPC, Shell Gas BV, and units of Société Nationale Elf Aquitaine and AGIP S.p.A agreed to form a project company early in 1988 that would build a 4.6-million-ton-per-year, two-train liquefied natural gas (LNG) plant at Bonny, which was a scaled-down version of an earlier proposal. The plant would liquefy gas provided by the four participants from onshore concessions and would begin shipping the LNG to Europe in 1995. The plan also included four LNG carriers, each with a capacity of 135,000 cubic meters. Given Nigeria's debt problems and the unfavorable condition of the world market, financing remained a significant problem. NNPC worked during the year to acquire firm commitments from buyers. Expressions of interest came from Belgium, France, the Federal Republic of Germany, Italy, and Spain.

NNPC announced that it planned to spend $106 million on a program to increase LPG production and set up a major distribution system that would provide a cheap fuel for Nigerian household, thereby reducing demand for kerosene and firewood. A 116,000-barrel-per-year LPG Merox plant would be built at the 90,400-bbl/d Kaduna refinery. The distribution infrastructure would comprise eight LPG storage depots at Lagos, Gombe, Calabar, Enugu, and Ibadan. NNPC would need four main-line locomotives, 150 rail cars, and 4 brake vans to transport the LPG.

Uranium.—Exploration for uranium in Mikat and Michika areas of Gongola State continued by Nigerian Uranium Mining Co., which was owned 60% by NMC and 40% by Total Compagnie Minière of France.

[1]Physical scientist, Division of International Minerals.
[2]International Mining. Aug. 1987, p. 88.

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